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COLLOQUIA – TRINITY TERM 2017

VENUE: **Hume Rothery Lecture Theatre (4pm)**

Refreshments will be served in the Hume Rothery Building Reception Foyer from 3:30pm

Week	*Date*	*Colloquium Title and Abstract*	*Host:*
1	Thursday , 27 April	**Prof Susan Perkin,** University of Oxford, Department of Chemistry **Ionic liquids and concentrated electrolytes: a challenge to our understanding of the liquid state** Ionic liquids can be loosely defined as salts that are in the liquid state under ambient conditions. There has been great interest in ionic liquids and other high-concentration electrolytes over the past decade or so, in part motivated by applications ranging from energy storage to electronics, yet many of their characteristics remain unexplained and out of reach with our existing theoretical toolkit. I will outline key advances in understanding ionic liquid structure and dynamics illustrated by examples from leading researchers around the world as well as our own contributions in this direction. Our measurements of surface forces and interactions in ionic liquids and concentrated electrolytes, using a Surface Force Apparatus, reveal both interfacial and bulk aspects of ionic liquids and uncover some anomalous properties and intriguing problems. Overall, I will propose that ionic liquids present an exciting challenge to our understanding of the liquid state as well as opening many avenues for designing materials for energy storage for the future.	PSG
2	Thursday, 4 May	**Dr Finn Giuliana,** Imperial College, London **In Situ Fracture Tests of Brittle Interfaces at the Microscale** The fracture toughness of ceramics is often dominated by the structure of their grain boundaries. Our capacity to improve the performance of ceramic components depends on our ability to investigate the properties of individual grain boundaries. This requires development of new fracture testing methods providing high accuracy and high spatial resolution. Recently, several techniques have been developed using small scaled mechanical testing, based within a nanoindenter, using a variety of tip and sample geometries, including: micropillar compression, microcantilever bending and double-cantilever compression. However, the majority of the published work relies on load-displacement curves for the identification of crack initiation and the geometries can result in a complex analysis of force distribution and stress intensity factor. Our approach uses a double cantilever geometry to obtain stable crack growth and we calculate the fracture energy under a constant wedging displacement. The tests are carried out within an SEM, this has two benefits: the sample is well aligned for a controlled test and images are recorded	DEJA

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		during the test for later analysis. Crucially this allows us to use beam deflection and crack length rather than critical load to measure fracture toughness. Our tests have proved it is possible to initiate and stably grow a crack in a controlled manner in ceramic materials for several microns. This approach has been validated on SiC where it gives a good approximation of the surface energy and then extended to SiC bi-crystals along with Ni-Al_2O_3 interfaces where crack blunting and bridging mechanism can be observed and measured.	
3	Thursday, 11 May	**Iain Todd,** University of Sheffield, and Director of MAPP **Metallurgical Challenges in Additive Manufacturing** Additive manufacture (AM) in metals is starting to be taken seriously by high value manufacturing sectors such as medical and aerospace, as much because of their potential to reduce material waste and product lead times as for the design freedoms they afford. At present however, the choice of materials that may be readily deployed in AM is rather limited and more "useful" alloys pose significant challenges. In this talk I will cover some of the issues faced and look to possible solutions drawing lessons from more traditional processing technologies such as casting, welding and sintering.	PSG
4	Thursday, 18 May	**Yiannis Vardaxoglou,** University of Loughborough **Meta-Atoms for 3D printing Metamaterials** In this seminar, Prof **Vardaxoglou** will introduce the concept and uses of Meta-Atoms in Electromagnetic metamaterials. 3D-printed multi-layered metamaterials with different periodicities of the metallic rectangular meso scale cuboid inclusions, termed here as meat-atoms. Potentially these meta-atoms could be varied in constitution and geometry to augment a variety of artificial magnetodielectric properties. The periodicity indicates the spaces between adjacent elements. The effect of the space on the effective EM properties is examined by placing the 3D-printed samples in a waveguide or on a resonator. Some of these structures have been applied in engineering applications such as antennas and microwave lenses.	PSG